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STANDARDIZATION OF COLOR NAMES
The ISCC-NBS Method^{1/}

By Dorothy Nickerson, Color Technologist, Agricultural Marketing Service,
and Secretary, Inter-Society Color Council

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The science of colorimetry has made great strides during the past 15 years. Two important contributing factors have been (1) the international adoption in 1931 of certain standards for illuminants, for methods of illuminating and viewing colors, for a standard observer, and certain conventions for expressing color data; and (2) the development of instruments for rapid and accurate color measurement. There is still a long way to go, but colorimetry is fortunate in that its workers not only believe in cooperative effort but through concerted effort actually have been able to develop active programs that have resulted in greater progress than would have been possible otherwise.

During general progress in this field, consideration has been given to the problem of developing a system of color names that would be based on a foundation firm enough to satisfy the color scientist, general enough to be acceptable and useful to the scientist, artist, and industrialist, and sufficiently commonplace to be understood, at least in a general way, by the whole public.

Because of its connection with problems which arise in the work of standardization of agricultural products, the color laboratory of this Service has cooperated with other color laboratories in the solution of this problem, the work having been done under the direction of committees of the Inter-Society Color Council, of which the American Society for Testing Materials is one of the eleven national associations that are member bodies. The problem of developing color names was presented to the Inter-Society Color Council at its first meeting in 1931 by the Revision Committee of the United States Pharmacopoeia. The report in 1933 of the Council's Committee on Measurement and Specification gave the basis which has been followed since then. Setting boundaries for the color names was the greatest problem, the work being done at the National Bureau of Standards. The work would have been impossible without the aid given by the American Pharmaceutical Association and the U. S. Pharmacopoeial Revision Committee who for this purpose jointly supported a research associateship at the National Bureau of Standards. A report of this work, with 34 charts

^{1/} Initials are for Inter-Society Color Council-National Bureau of Standards.

of name boundaries^{2/} was published in September 1939 by the National Bureau of Standards. The method is the result of the joint work of all important standardization groups interested in color, for the letter ballot of the Inter-Society Color Council regarding adoption of this method showed that 26 out of 27 votes received (33 possible) were for adoption. Each association has three voting delegates in the Council, which accounts for the possible 33, and except for one association vote marked "not voting" there were at least two affirmative votes from each association in the Council. There were no negative votes.

The method adopted is simple in principle. The terms light, medium, and dark designate increasing degrees of darkness, the adverb "very" is added to extend the lightness scale to "very light" and "very dark." The adjectives weak, medium, strong, vivid designate increasing degrees of chroma. In order that unwieldy adjective combinations shall not be required, the following terms may be substituted for certain descriptions:

pale	as a substitute for	light, weak
brilliant	" " "	" light, strong
moderate	" " "	" medium, medium
dusky	" " "	" dark, weak
deep	" " "	" dark, strong

The relationship of these adjective modifiers is shown in figure 1.

These terms are used to modify the following hue or limited hue range names: pink, red, orange, brown, yellow, olive, green, blue, purple, and combinations of these terms formed by using two of them, as in Blue Green, or an -ish suffix with one, as in purplish Pink. For the neutral series the terms, white, gray, and black are used.

Certain of the hue names cover all lightnesses and chromas, as in the case of Green. But certain other hue names cover only a limited range of lightnesses and chromas, as the Pinks which are really very light Reds, and the Olives which are actually dark Yellows. But common usage is so strong in regard to such terms that the ISCC-NBS^{1/} method has taken them into consideration, and

very pale (very light, weak)	very light	very brilliant (very light, strong)	vivid (very strong)
pale (light, weak)	light	brilliant (light, strong)	
weak	moderate	strong	
dusky (dark, weak)	dark	deep (dark, strong)	
very dusky (very dark, weak)	very dark	very deep (very dark, strong)	

Figure 1. Relation of adjective modifiers.

^{2/} Deane B. Judd and Kenneth L. Kelly, Method of Designating Colors, NBS J. Research, 23, 355, Sept. (1939); RP 1239. Copies of report obtainable from Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

has applied different names to limited ranges of lightnesses and chromas of a single hue. To constant hues in certain Yellow-Reds, the name Brown is given to the dark group of colors, the term Orange to those that are light and medium-to-strong in chroma, and the term Orange-Pink to those for light and weak Yellow-Reds. Each of the terms, Brown, Orange, and Orange-Pink is then divided into several designations by the use of appropriate modifiers selected from those shown in figure 1.

The relationship of these names can be explained most easily by reference to what is known as a color solid. Because the three color attributes of any surface color may be represented in a three-dimensional solid, it is often called a surface-color solid. The dimensions of this solid are hue, lightness, and chroma, which are diagrammatically represented in figure 2. The scale of lightness starts at the bottom of the scale, and is measured in lightness units from 0 at black, to 10 (or 100) at white. Hue is represented by an angle about the black-white axis, giving a closed series of red, yellow, green, blue, and purple, back to red, including all intermediate hues in their proper positions. Chroma is represented by distance from the black-white axis on a radius extending to the boundary of the solid, the grayest colors being near the center of the solid, the vivid colors at the surface of the solid. The numbers on the diagrams represent the Munsell notation.

The color designations of the ISCC-NBS system therefore define a block in the surface-color solid, and the complete system provides for 312 such blocks. This number is quite sufficient for naming colors from memory, but it means that each block contains a number of distinguishable colors.

The boundaries of each name designation are given in 34 charts included in the Judd-Kelly report². For simplicity and ease of reference the limits are reported at the present time in terms of the Munsell color notation. It may be desirable ultimately to supplement this practical definition of limits for each color designation by giving equivalent definitions in terms of the 1931 internationally adopted coordinate system, since it does not depend upon a material set of standards, as does the Munsell system. However, interpolation curves made available by the laboratories of the Agricultural Marketing Service³ already permit a fairly reliable transfer from Munsell notation to ICI specification, and it is expected that conversion tables of the colors in the Maerz and Paul Dictionary of Color will soon be available in Munsell notation. This will enable the use of the standard ISCC-NBS color name by reference to the ICI, Maerz and Paul Dictionary, or the Munsell system directly, through the use of published conversion tables.

The simplest equipment for using the ISCC-NBS names with a reasonable assurance of accuracy is a good light, a set of pocket-sized Munsell charts, and a mask made of a neutral gray (near medium lightness unless there is a special reason for selecting one lighter or darker).

³ Dorothy Nickerson, Use of ICI Tristimulus Values in Disk Colorimetry. Mimeographed Preliminary Report. 1938. United States Department of Agriculture.

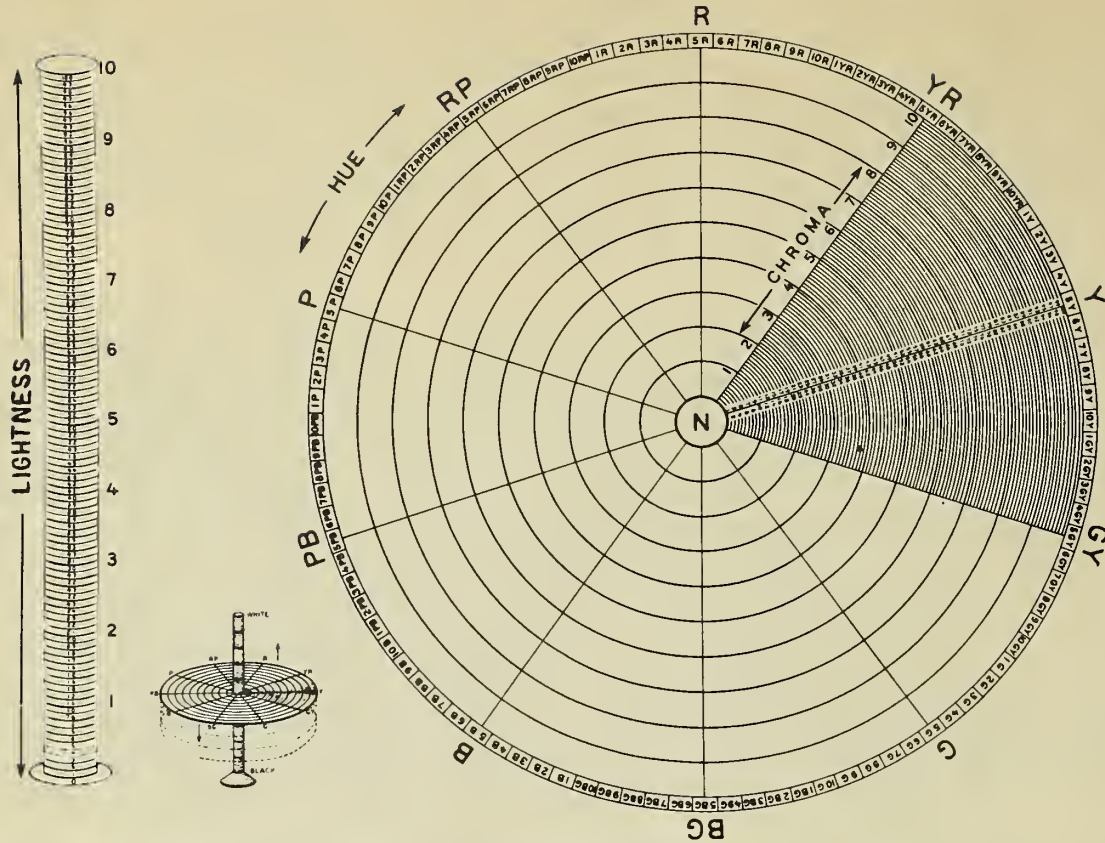


Figure 2. Hue, lightness, and chroma in their three dimensional relationship. The letters and numbers represent the Munsell notation.

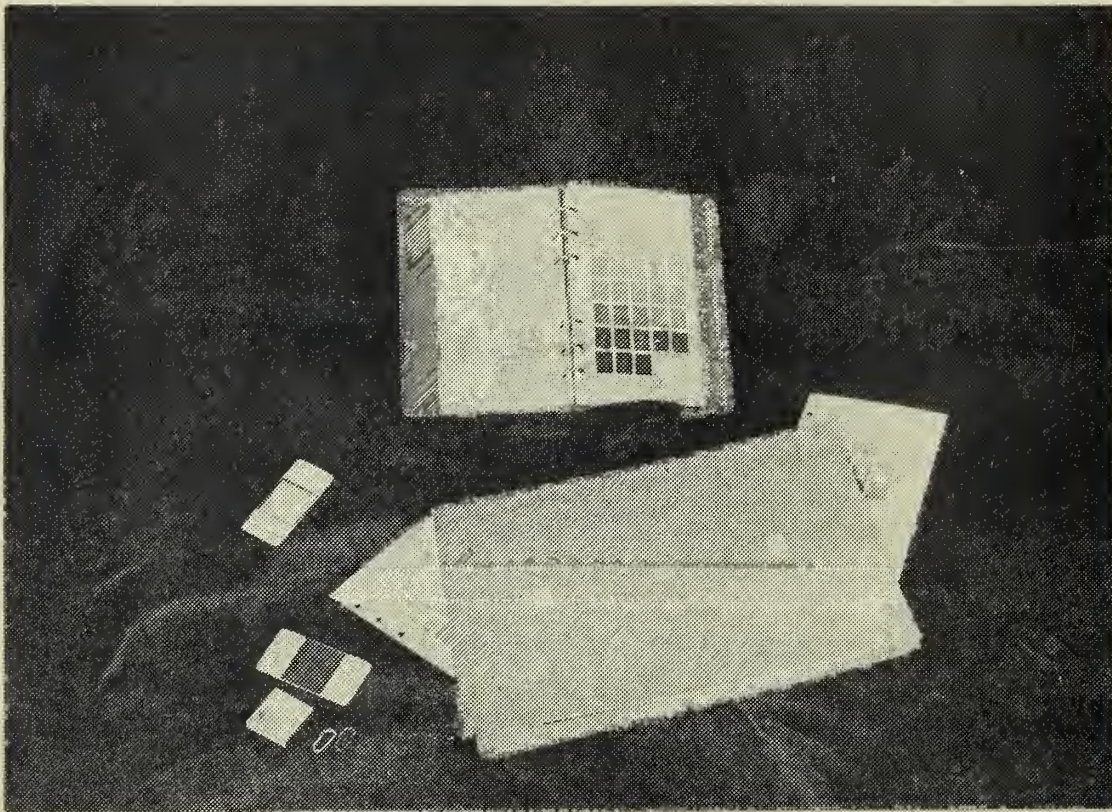


Figure 3. Charts and mask used in obtaining ISCC-NBS color designations.

In the mask there should be three rectangular holes the size of the color chips on the charts. Such a mask and charts are shown in figure 3. Because textiles have a flat surface, they can be placed directly behind the center opening of the mask. One or more layers may be used, as may seem necessary. The angle of illumination and viewing, particularly on glossy silks, must be kept constant, preferably at 45° illumination, normal viewing. If the color should be a red, slightly toward the purple, the two Munsell charts nearest this hue would be selected and placed, one under each side of the mask. The two color charts are then adjusted until an estimation of hue, of lightness, and of chroma of the textile may be made to one step of hue (in 100), to 0.1 step of lightness, and to 0.1 step of chroma. The name is then looked up by reference to the boundary charts published by Judd and Kelly².

Because abbreviations will be probably used more often than not for the ISCC-NBS color designation, a notation for recording them is given in table 1. Capital letters refer to the noun form of the hue name; lower case letters are used for the adjective form. Since blue, brown, and black all begin with B, they are distinguished by writing the abbreviation B for blue, Br for brown, Bl for black. Green and gray are distinguished by using G for green, Gr for gray. Orange and olive are distinguished by using O for orange, Ol for olive.

Table 1. Abbreviations for use with ISCC-NBS system of designating colors.

Noun form of hue	Adjective form of hue	Adjective modifiers
Pk pink	pk pinkish	lt light
R red	r reddish	dk dark
O orange	O orange	wk weak
Br brown	br brownish	str strong
Y yellow	y yellowish	mod moderate
Ol olive	Ol olive	med medium
G green	g greenish	viv vivid
B blue	b bluish	
P purple	p purplish	
Wh white		<u>Adverb modifier</u>
Gr gray		
Bl black		v very

The color name charts of this system are illustrated in figures 4-10.

It is expected that the first important use of these names will be made in the next revision of the National Formulary. This volume and the U. S. Pharmacopoeia, in which the names will also appear either in the present revision or the one following, are required on the shelves of all pharmacists. Thus there will be widespread acquaintance with

these names. Another important application will be in the field of soil science, the ISCC-NBS names applicable to soil colors to be illustrated by charts containing color samples of the names. Various other groups are meanwhile studying the application of these color designations in fields where a standard system of this sort may be useful.

It is necessary to warn the person who may over-enthusiastically suppose that all his color name or color designation problems have now been solved. The ISCC-NBS names are standard, but they are applicable only when it is possible to group a number of distinguishable colors under a single color name. There are 312 names in the system, a number quite sufficient for naming colors from memory, but since it is estimated that man can distinguish more than ten million surface colors, such a system of color names will not answer all problems of color designation. When more than 312 names are necessary, a system of numerical notation is advised, for such notations can readily be extended to any number of colors, while names cannot.

In the textile industry there are problems to which this system is applicable, but it is not meant to replace color names used for sales appeal in merchandising. Nor can it replace standards such as those of the Textile Color Card Association of the United States, which have a very strict tolerance and must be matched with close fidelity if problems of matching in costumes are to be avoided after various types of merchandise are made up. It can be used for purposes of grouping similar colors. It can be used also to make fashion and seasonal names more understandable. Do you, for example, know that Capucine, Chamoline, and Alesan are color names? According to the ISCC-NBS system, Capucine is a moderate yellow, Chamoline is a dusky yellowish orange, and Alesan is a pale to light brown. Dozens of other quite color-meaningless names can be visualized with good approximation by the use of these standard names.

And for such problems as those to which it is applicable, it is to the advantage of all groups concerned that they be acquainted with the ISCC-NBS system and use it. It is in order to acquaint you with this standard method and to urge that you use it in all problems where it is applicable, that I call it to your attention today.

The adoption of a report by the Inter-Society Color Council, and the consequent publication of that report by the National Bureau of Standards have provided standard color names in theory; only the widespread use of these color names will make them standard in fact. From now on it is you, and I, and all others to whom color naming problems come, who will actually be responsible for the degree of success this standard system of color designation will have.

Yellow

Yellow

yellowish white	pale	light	brilliant	
yellowish gray	weak	moderate	strong	vivid
	dusky	dark	deep	

greenish Yellow

pale	light	brilliant	
weak	moderate	strong	vivid
dusky	dark	deep	

Greens

Olive Green

weak	moderate	strong	
dusky	dark	deep	

Yellow Green

pale	light	brilliant	
weak	moderate	strong	vivid
dusky	dark	deep	

yellowish Green

very pale	very light		
pale	light	brilliant	
weak	moderate	strong	vivid
	dark	deep	
	very dark	very deep	

Green

greenish white	very pale	very light	very brilliant	
light greenish gray	pale	light	brilliant	
medium greenish gray	weak	moderate	strong	vivid
dark greenish gray	dusky	dark	deep	
greenish black	very dusky	very deep		

Olive

Olive

light olive gray	pale	light	
olive gray	weak	moderate	
olive black	dusky	dark	

bluish Green

very light			
light		brilliant	
moderate		strong	vivid
dark		deep	
very dark			

Blue Green

very pale	very light		
pale	light	brilliant	
weak	moderate	strong	vivid
dusky	dark	deep	
very dusky	very dark		

Figure 6. ISCC-NES color designations for the yellow and olive series.

Figure 7. ISCC-NES color designations for the greens.

greenish Blue			Blue		
very light	light	brilliant	bluish white	very pale	very light
			light bluish gray	pale	light
			medium bluish gray	weak	moderate
			dark bluish gray	dusky	dark
			bluish black		deep
					vivid

bluish Purple			Purple		
very pale	very light	very brilliant	purplish white	very pale	very light
pale	light	brilliant	light purplish gray	pale	light
weak	moderate	strong	medium purplish gray	weak	moderate
dusky	dark	deep	dark purplish gray	dusky	dark
			purplish black	very dusky	very deep
					vivid

purplish Blue		
very pale	very light	very brilliant
pale	light	brilliant
weak	moderate	strong
dusky	dark	deep
		vivid

reddish Purple		
very pale	very light	brilliant
pale	light	brilliant
weak	moderate	strong
dusky	dark	deep
very dusky	very dark	very deep
		vivid

Red Purple		
	pale	light
	weak	moderate
	dusky	dark
	very dusky	very dark
		very deep
		vivid

Figure 8. ISCC-NBS color designations for the blues.

Figure 9. ISCC-NBS color designations for the purples.

Grays and Near Grays

	Neutrals	Pink	Red	Brown	Yellow	Olive	Green	Blue	Purple
White		pinkish white			yellowish white	greenish white	bluish white	purplish white	
light gray		pinkish gray			yellowish gray	light greenish gray	light bluish gray	light purplish gray	
medium gray		reddish gray	light brownish gray		light olive gray	medium greenish gray	medium bluish gray	medium purplish gray	
dark gray		dark reddish gray	brownish gray		olive gray	dark greenish gray	dark bluish gray	dark purplish gray	
Black		reddish black	brownish black		olive black	greenish black	bluish black	purplish black	

Figure 10. ISCC-NBS color designations for the grays.

